Docket No.: 1293.1296

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Young-ran SONG, et al.

Serial No. 10/016,685 Group Art Unit: 3628

Confirmation No. 2581

Filed: December 17, 2001 Examiner: Unassigned

For: WEARABLE DISPLAY SYSTEM

SUBMISSION OF VERIFIED TRANSLATIONS OF PROVISIONAL APPLICATIONS

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the provisions of 37 C.F.R. § 1.78, the applicant(s) submit(s) herewith translation(s) of the following provisional application(s):

U.S. Provisional Application No. 60/255,448

Filed: December 15, 2000

U.S. Provisional Application No. 60/257,283

Filed: December 26, 2000

It is respectfully requested that the applicant(s) be given the benefit of the provisional filing date(s) as evidenced by the translation papers attached hereto, in accordance with the requirements of 35 U.S.C. § 119.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 3-29-02

By: M. Badagliacca
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IN THE MATTER OF

U.S. Provisional Application No. 60/255,448

By Samsung Electronics Co., Ltd

I, So-hee Kim, an employee of Y.P.Lee & Associates of The Cheonghwa Bldg., 1571-18 Seocho-dong, Seocho-gu, Seoul, Republic of Korea, hereby declare that I am familiar with the Korean and English language and that I am the translator of the U.S. Provisional Application and certify that the following is to the best of my knowledge and belief a true and correct translation

Signed this 11th day of January 2001.

Sohee Kim

Binocular Waveguide NED
(Near Eye Display)

BACKGROUND OF THE INVENTION
PRIOR ART
DETAILED DESCRIPTION OF THE INVENTION
TYPES OF GRATING
TYPES OF NEAR EYE DISPLAY (NED)
TYPES OF MAGNIFY LENSE
CLAIMS

BACKGROUND OF THE INVENTION

EXISTING HEAD MOUNT DISPLAYS (HMDs) ARE HEAVY AND BULKY, AND ARE DIFFICULT TO DESIGN ON ACCOUNT OF THE USE OF MANY LENSES.

NEAR EYE DISPLAYS (NEDs) ACCORDING TO THE PRESENT INVENTION HAVE WAVEGUIDE SHAPES, SO THAT THEY ARE LIGHT, SMALL AND SHORT.
ALSO, NEDs ACCORDING TO THE PRESENT INVENTION USE GRATINGS, HOLOGRAM LENSES AND REFRACTION LENSES.

PRIOR ART

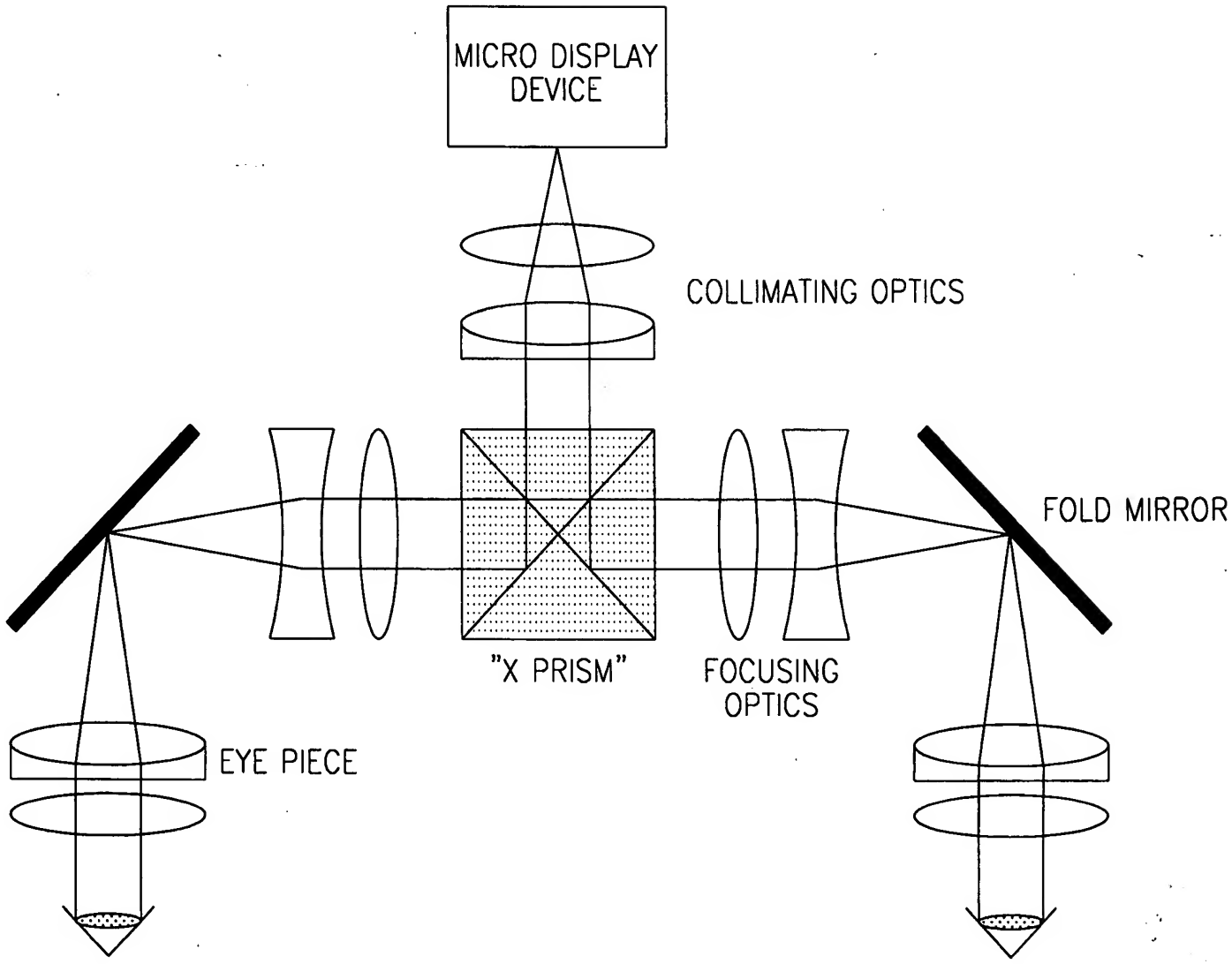


FIG. 1 : BINOCULAR HMD OPTICAL SYSTEM

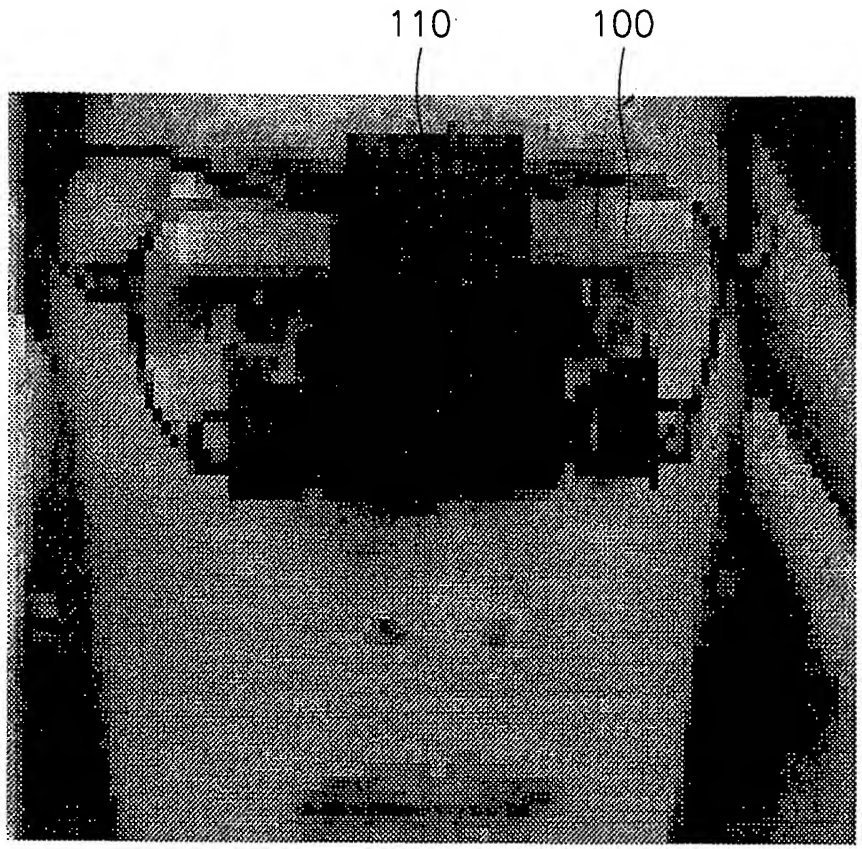


FIG. 2 : EXAMPLE OF BINOCULAR HMD

DETAILED DESCRIPTION OF THE INVENTION

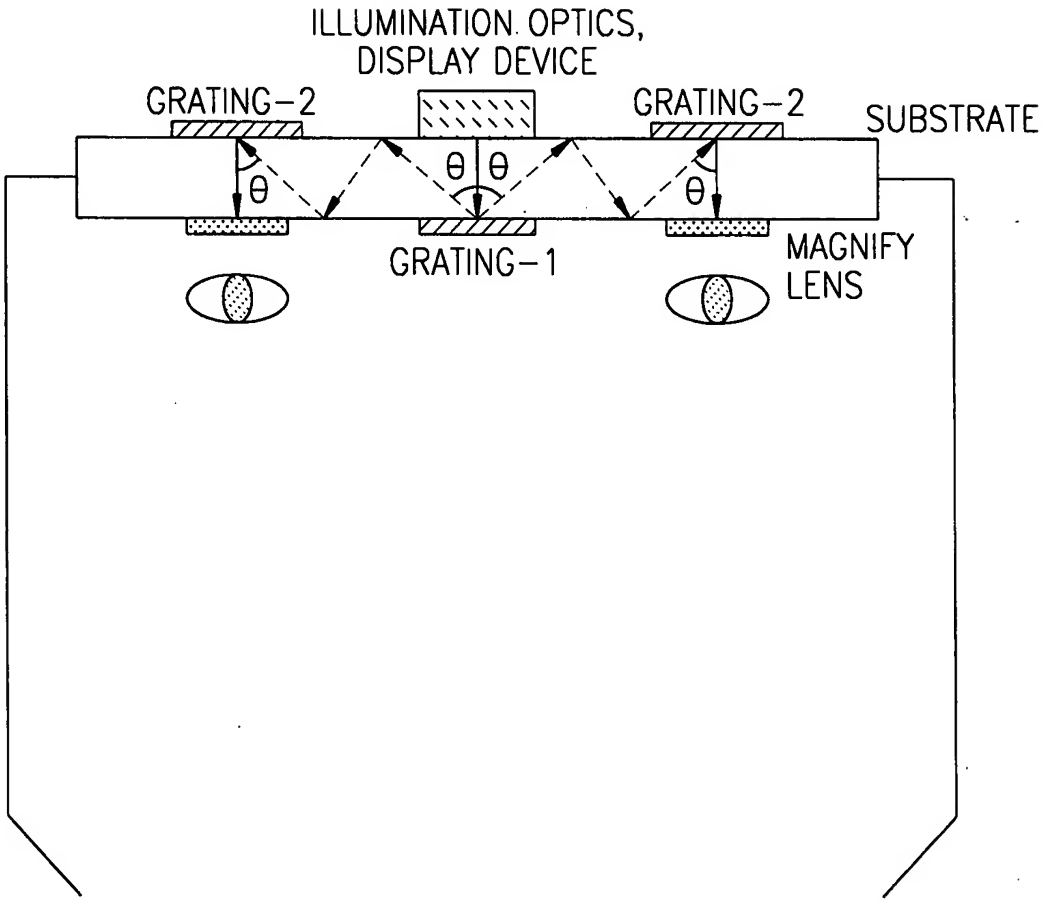


FIG. 3 : SCHEMATIC VIEW OF BINOCULAR NED

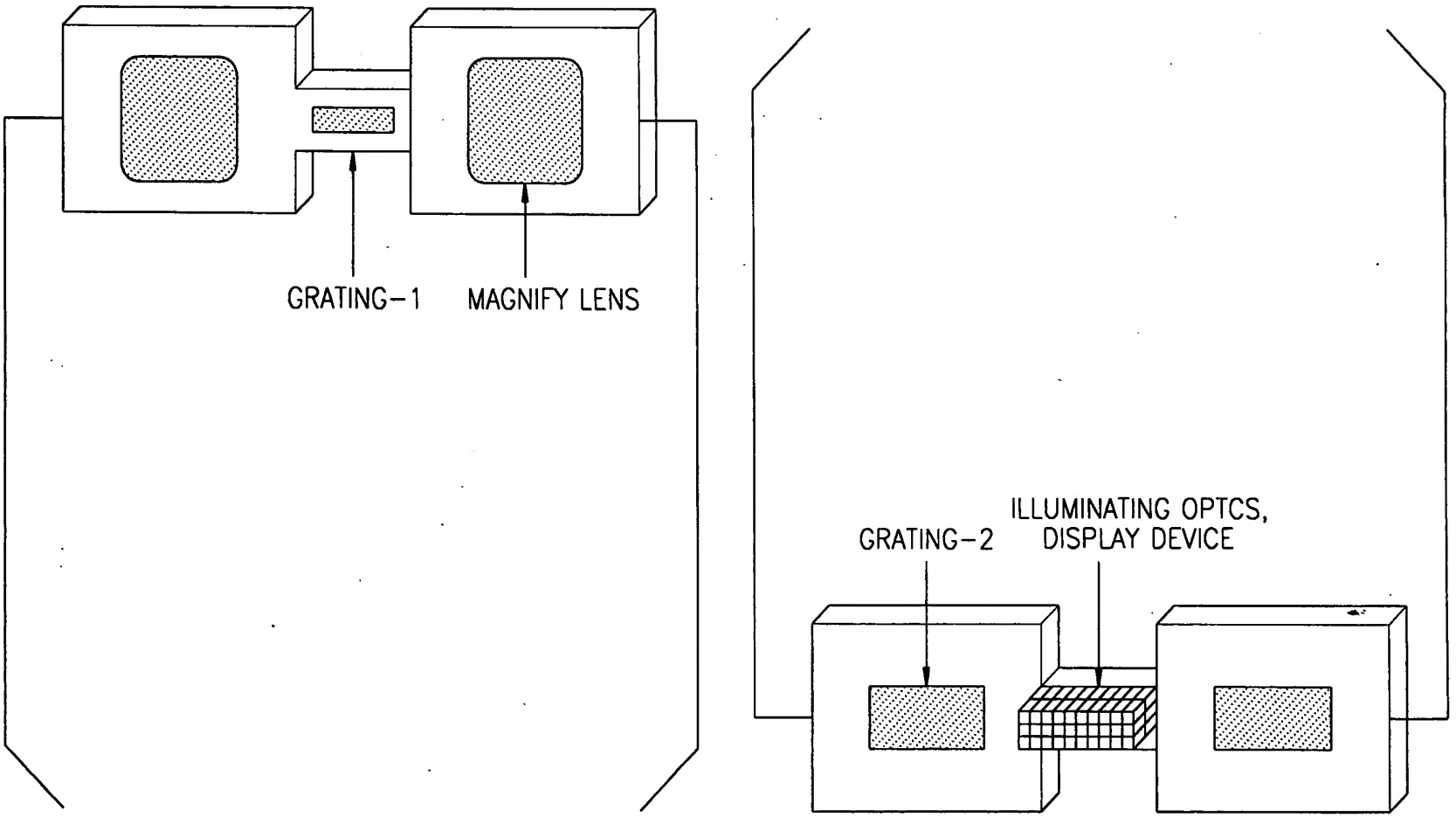


FIG. 4 : FRONT SIDE AND REAR SIDE OF BINOCULAR NED

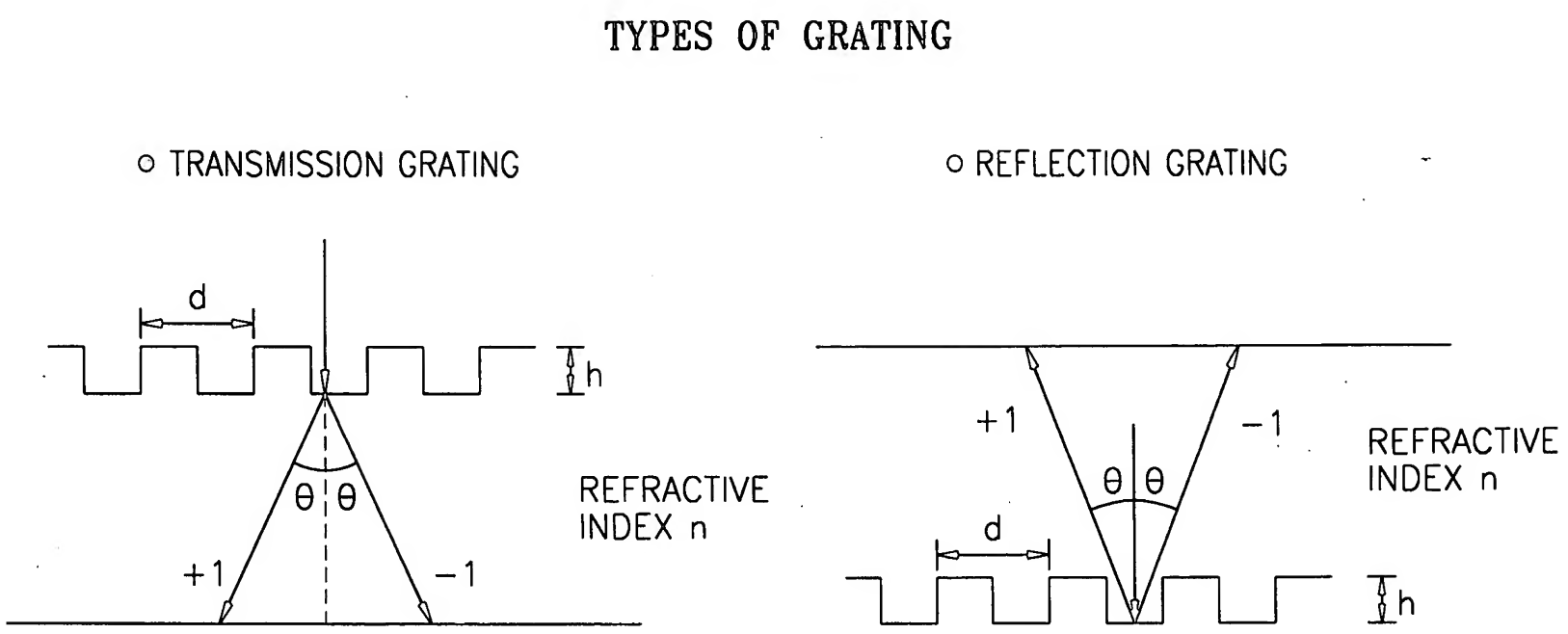
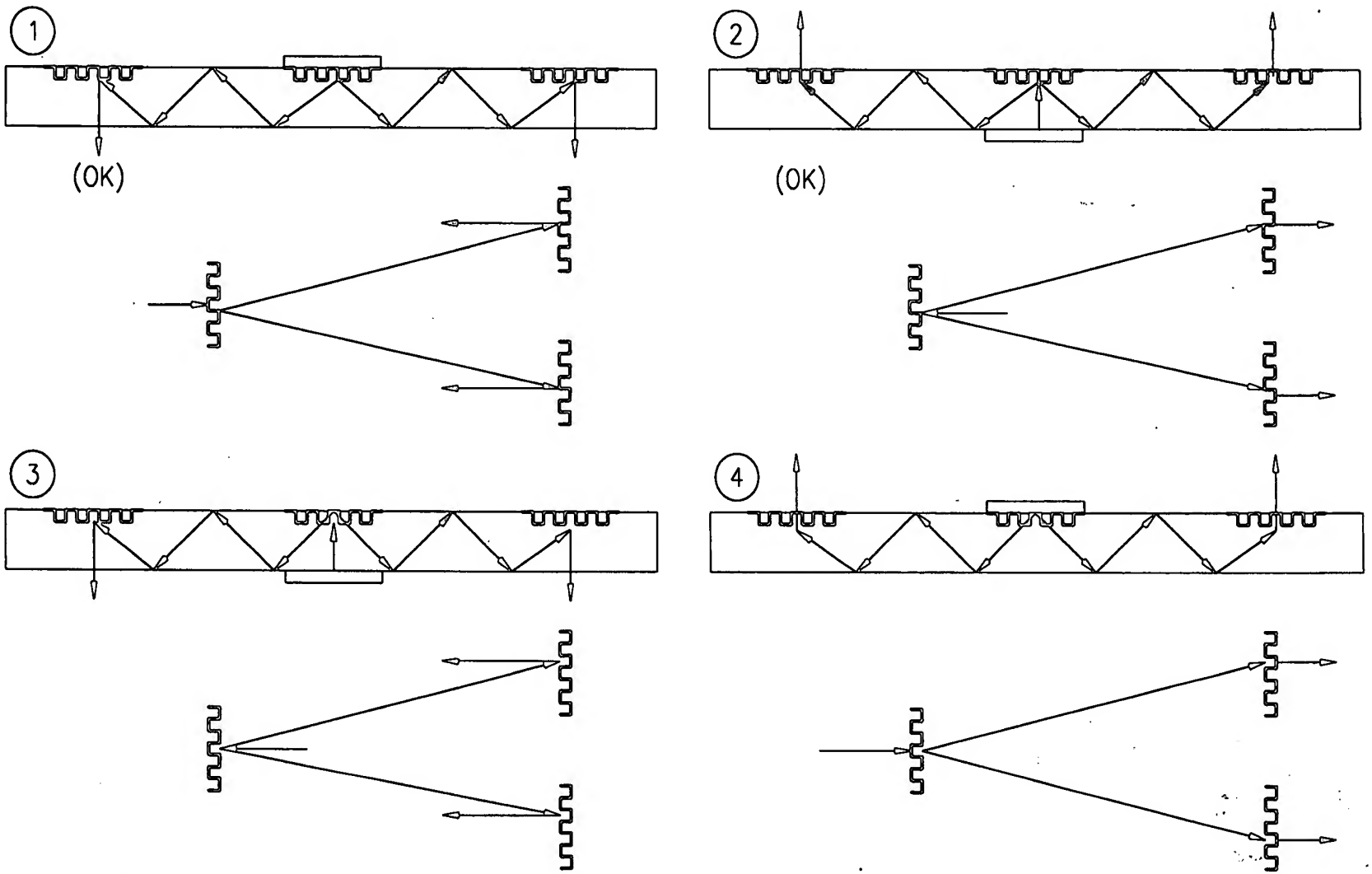


FIG. 5 : TYPES OF GRATING

TYPES OF NED (TYPES AND POSITIONS OF GRATING)



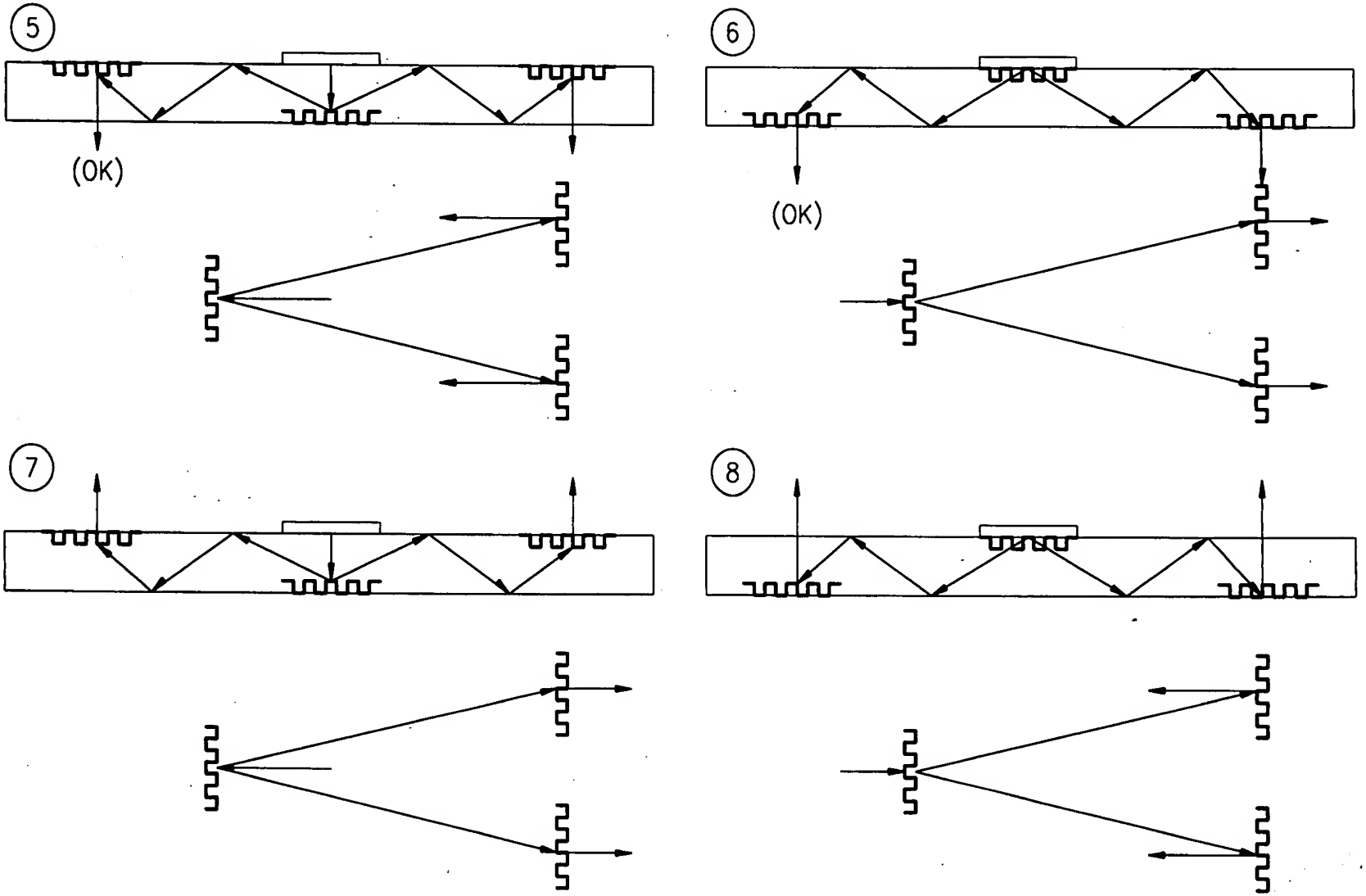


FIG. 6 : TYPES OF NED

1. Description of Prior Art (problems)

* Description of FIG. 1

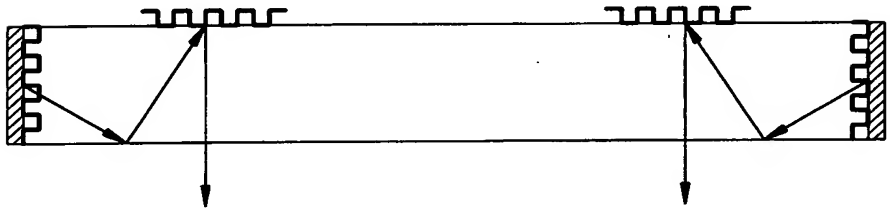
Light (image) emitted from one point of a micro display device is collimated by a collimating lense and then incident upon an X prism that can disperse light toward right and left directions. Light passed through the X prism is still parallel light, so it is focused by a focusing lense and then reflected by a fold mirror. When the reflected light is observed through eye piece lenses, the image from the micro display device looks magnified. Here, a lense for removing chromatic aberration is used as the eye piece lense in order to achieve color display.

The above-described binocular HMD optical system has the following disadvantages. Firstly, this system includes a collimating lense, an X prism, a focusing lense, a fold mirror and an eye piece lense, so that lense designing is difficult and time-consuming. Secondly, alignment of lenses is difficult, and this optical system is difficult to manufacture. Thirdly, this HMD optical system is too heavy and bulky for people to wear like a glass, a headphone or an earphone. Fourthly, this HMD optical system requires many optical components, thus increasing the manufacturing costs. Fifthly, an eye piece lens for removing chromatic aberration must be separately designed.

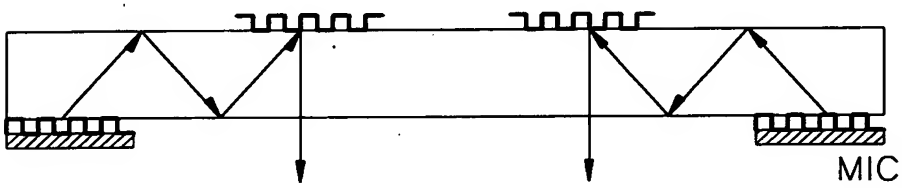
NEW TYPES OF BINOCULAR NED :

CONSTITUENTS : TWO MICRO DISPLAYS
FOUR GRATINGS
TWO MAGNIFY LENESE

1. BINOCULAR NED (2 MICRO DISPLAY)



2. BINOCULAR NED (2 MICRO DISPLAY)



2. Description of the Invention (Equation and Basic principle)

* Description of FIG. 3

The principle of an NED is that an object within the focal distance, **f**, of a lense in front of an eye looks magnified. The focal distance **f** is determined according to the size of an object and the size of a magnify screen.

Referring to FIG. 3, when light from a micro display device is vertically incident upon a grating-1, the grating-1 bidirectionally bends the incident light by θ so that the incident light has an internal total reflection θ on a substrate. The internal total reflection θ is calculated by Equation 1:

$$\theta = \sin^{-1}\left(\frac{1}{n}\right) \qquad \text{...(1)}$$

wherein the numerator of a fraction is set to be the refractive index of air, that is, 1.

The path of light traveling within the substrate must be shorter than the focal distance **f** of a magnify lense in front of the eye. For example, if the refractive index of the substrate is **n**, and the thickness thereof is **t**, **n×t** must be shorter than the focal distance **f** of a magnify lense. The type and thickness of the substrate and the number of times of total reflection performed within the substrate are determined by the focal distance **f**. However, the focus and size of the magnify lense must be preferentially determined in consideration of the size of a display device and the size of a magnifying screen that is adequate for the purpose of use of the NED. This helps designing of the total structure of the NED. The type and thickness of a substrate and the number of times of reflection are determined. This description refers to separately-annexed DRAWING 1.

When light is incident upon grating-2 at the angle θ by which light is bent by the grating-1, it is applied perpendicularly to the surface of the magnify lense. Here, the grating-1 and the grating-2 must have the same grating interval, **d**, and be parallel to the substrate in order to have a compensation effect (see DRAWING 2 separately annexed).

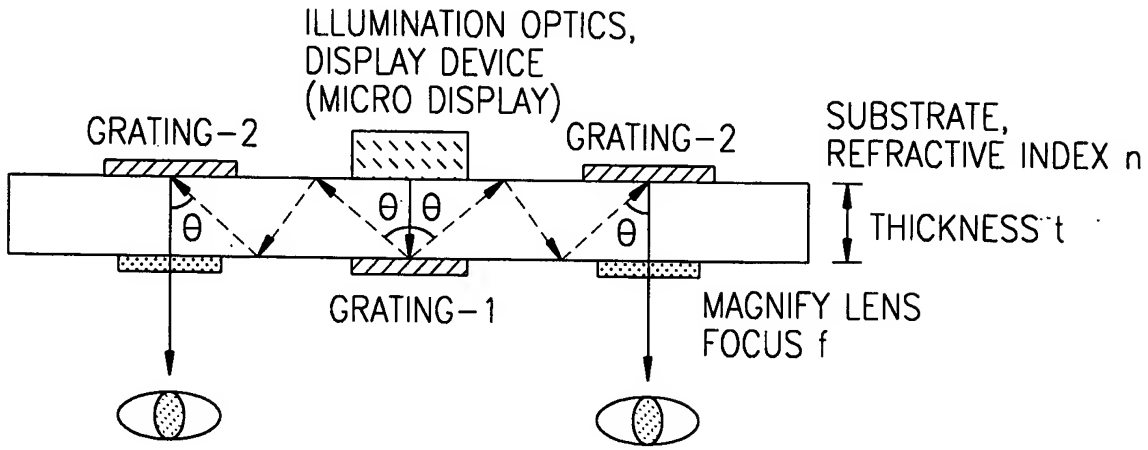
3. Description of Gratings (a transmission type grating and a reflection type grating)

4. Connection of No. 2 to No. 3

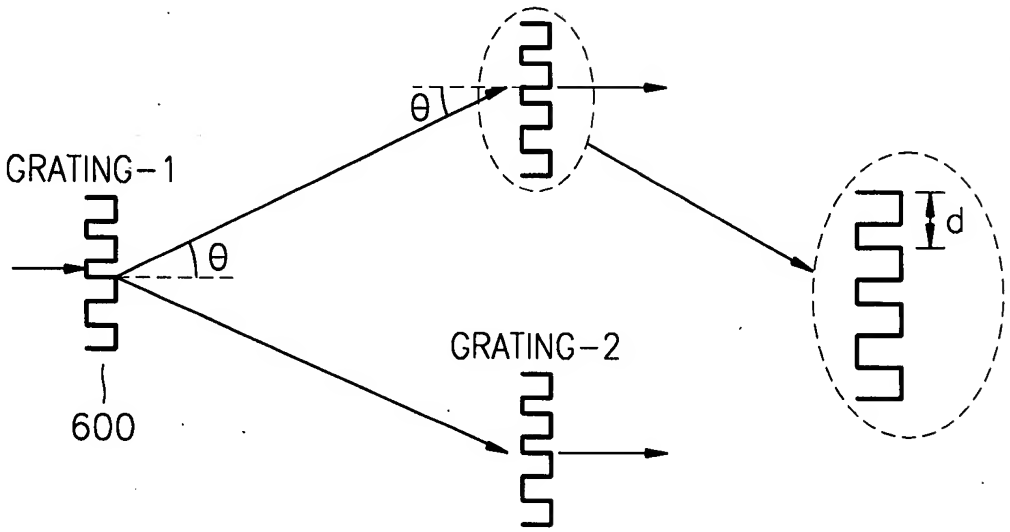
5. Removal of chromatic aberration

6. Effect

The binocular NED according to the present invention is a light, small, short and cheap eyeglass-type personal display. This binocular NED is simply manufactured and designed using a small number of optical components. The external shape of the binocular NED can vary easily and sensitively according to the fashion. Since optical components can be incorporated into a substrate by lithography, the binocular NED can be mass-produced.



DRAWING 1 : INCIDENCE ANGLE, OPTICAL PARAMETERS OF SUBSTRATE AND FOCUS OF LENSE



DRAWING 2 : COMPENSATION OF TWO GRATINGS